

WHAT IS CLAIMED IS:

1. A gradient copolymer comprising at least two monomers, the first (M_1), the homopolymer of which
5 corresponding to a Tg_1 of less than 20°C , representing at least 50% by weight of the total weight of the copolymer, the second (M_2), the homopolymer of which corresponding to a Tg_2 of greater than 20°C and preferably of greater than
10 50°C , representing at most 50% by weight of the total weight of the copolymer, at least one of the monomers having to be hydrophilic and represent at least 5% by weight of the total weight of the copolymer, characterized in that it comprises at
15 least one monomer M_i such that the probability of encountering M_i in any standardized position x situated on the polymer chain is nonzero.
2. The copolymer as claimed in claim 1, characterized
20 in that Tg_1 is between -150 and 20°C and preferably between -120 and 15°C .
3. The copolymer as claimed in claim 1 or 2,
25 characterized in that it exhibits average masses of between 5000 g/mol and $1\,000\,000\text{ g/mol}$ and exhibits polydispersity indices of between 1.1 and 2.5, preferably between 1.1 and 2.
4. The copolymer as claimed in one of the preceding
30 claims, characterized in that the hydrophilic monomer represents at least 10% by weight of the total weight of the copolymer.
5. The copolymer as claimed in one of the preceding
35 claims, characterized in that the hydrophilic monomer is chosen from the group consisting of:
 - ethylenic carboxylic acids, such as acrylic acid, methacrylic acid, itaconic acid or fumaric

acid,

- acrylates and methacrylates of polyethylene glycol or of glycol which are or are not substituted on their end functional group by alkyl, phosphate, phosphonate or sulfonate groups,
- amides of unsaturated carboxylic acids, such as acrylamide or methacrylamide and their N-substituted derivatives,
- aminoalkyl acrylates and methacrylates, and aminoalkylmethacrylamides,
- carboxylic anhydrides carrying a vinyl bond, such as maleic anhydride or fumaric anhydride,
- vinylamides, such as vinylpyrrolidone or vinylacetamide,
- vinylamines, such as vinylmorpholine or vinylamine,
- vinylpyridine.

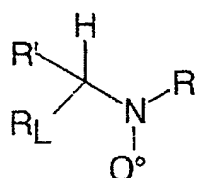
6. The copolymer as claimed in one of claims 1 to 5, characterized in that the monomer M_1 is chosen from the following monomers:

- linear or branched C_1 - C_{12} alkyl acrylates,
- polyethylene glycol acrylate or (meth)acrylate,
- dienes, such as butadiene or isoprene.

7. A process for producing a gradient copolymer by the solution or bulk controlled radical polymerization, at a temperature of between 10 and 160°C and preferably between 25 and 130°C, in the presence of a radical polymerization initiator and of an agent for controlling the polymerization, of a mixture of monomers comprising at least two monomers, the first (M_1), the homopolymer of which corresponding to a Tg_1 of less than 20°C, preferably of between -150 and 20°C and more preferably still of between -120 and 15°C, representing at least 50% by weight of the total weight of the mixture, the second (M_2), the homopolymer of which corresponding to a Tg_2 of

greater than 20°C and preferably of greater than 50°C, representing at most 50% by weight of the total weight of the mixture, at least one of the monomers having to be hydrophilic and represent at least 5% by weight of the total weight of the mixture.

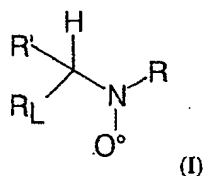
8. The process as claimed in claim 7, characterized in that the agent for controlling the polymerization is a nitroxide of general formula:

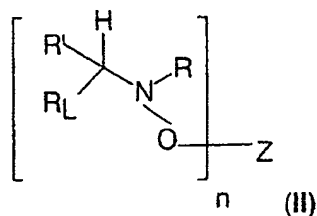


- where R' and R, which are identical or different and which are optionally connected so as to form a ring, are alkyl groups having between 1 and 40 carbon atoms which are optionally substituted by hydroxyl, alkoxy or amino groups; preferably, R and R' are tert-butyl groups;

- and where RL is a monovalent group with a molar mass of greater than 16 g/mol which can be a phosphorus group or an aromatic group.

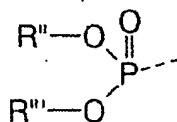
9. The process as claimed in claim 7, characterized in that the polymerization initiator and the control agent are advantageously replaced by a mixture composed of alkoxyamine corresponding to the following general formula (II) and of nitroxide corresponding to the general formula (I):





in which:

- n is an integer of less than or equal to 8 and preferably of between 1 and 3,
 - Z is a carrying monovalent or polyvalent radical of styryl, acryloyl or methacryloyl type,
 - where R' and R, which are identical or different and which are optionally connected so as to form a ring, are alkyl groups having between 1 and 40 carbon atoms which are optionally substituted by hydroxyl, alkoxy or amino groups; preferably, R and R' are tert-butyl groups;
 - and where R_L is a monovalent group with a molar mass of greater than 16 g/mol which can be a phosphorus group or an aromatic group,
- the nitroxide (I) representing from 0 to 20% by weight of the total weight of the mixture.
10. The process as claimed in claim 8 or 9, characterized in that, in particular, R_L is a phosphorus group and more particularly a phosphonate group of formula:



- where R'' and R''', which are identical or different and which are optionally connected so as to form a ring, are alkyl groups having between 1 and 40 carbon atoms which are optionally substituted by hydroxyl, alkoxy or amino groups;

in particular, R'' and R''' are ethyl groups;
the nitroxide (I) representing from 0 to 20% by
weight of the total weight of the mixture.

- 5 11. A process for the aqueous dissolution, according
to the following stages, of the gradient
copolymers of claims 1 to 6 or capable of being
obtained according to the process of claims 7 to
10:
- 10 1) the copolymer is dissolved in a ketone
solution, such as acetone or methyl ethyl ketone
(MEK), at a level of solid of between 20 and 90%,
preferably between 20 and 50%,
- 15 2) the solution obtained in 1 is neutrali-
zed, if necessary, by addition of a molar solution
either of acid or of base, the acid or base choice
being conditioned by the chemical nature of the
hydrophilic monomer,
- 20 3) water is then added, with vigorous stir-
ring, to the solution obtained in 1 or optionally
in 2 in a proportion such that the level of solid
obtained is between 1 and 80%; optionally, the
water can be replaced by water/alcohol mixtures in
proportions ranging from 99/1 to 50/50;
- 25 4) the ketone is evaporated until the
desired level of solid is obtained.
12. An aqueous solution, obtained according to the
process of claim 11.
- 30 13. The use of the gradient copolymer of claims 1 to 6
or capable of being obtained according to the
process of claims 7 to 10 in formulations for
paints, adhesives or glues and in cosmetic
35 formulations.
14. The use of the gradient copolymer of claims 1 to 6
or capable of being obtained according to the
process of claims 7 to 10 for pigment dispersion.

15. The use of the aqueous solution of claim 12 in formulations for paints, adhesives or glues and in cosmetic formulations.

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16. The use of the aqueous solution of claim 12 for pigment dispersion.